The value of gas storage – Towards a new role in the gas supply chain?

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Gas storage facilities are an essential tool of the natural gas supply chain. Fully booked and filled up before winter season storage capacities are the backbone of Europe’s security of supply as gas in storage sites are located physically close to the demand area. Ideally, the market should have the right incentives to make full use of storage capacities. Unfortunately this is not reflected in the current market conditions for flexibility services from UGS. Over the last five years market prices for storage capacities have dropped below cost level for storage operators (SSOs). The insurance and system stability value of UGS is seen as a public good and not valued in market prices. SSOs are reacting with project shifts, termination and depreciation of their investments. A reduction of storage capacities in Europe in the coming years would be in conflict with increasing flexibility demand coming from growth in import dependency through pipelines from distant sources and the increase of low carbon indigenous sources in the energy mix, which means more demand for flexibility in the power market. What will be the future role of UGS in providing physical gas flexibility in the future low carbon energy system?

1. VALUE DRIVERS OF GAS STORAGE SERVICES

Increasingly integrated and more liquid markets create various opportunities for market parties. Today a gas supplier can chose between a variety of competing flexibility tools, such as storage, spot purchases, LNG cargos, flexibility from Long-term supply contracts or interruptible contracts. But all of these tools differ in terms of price, the nature of the service (asset-backed or purely commercial) and availability. Their use ultimately depends on the shipper’s portfolio and strategies. The choice of flexibility tools is always driven mainly by economics (Figure 1).

Storage is a flexibility tool that can be physically guaranteed allowing a gas supplier or trader to hedge the supply and price risk. It provides an insurance against unexpected events. Such events may be of different nature but are often triggered by weather conditions, for instance cold snaps or prolonged periods of below-normal temperatures, as those witnessed in Europe in 2012 and 2013 as you can see in Figure 4.

1 Underground Gas Storage (UGS) There are in principal two ways of storing gas underground: the storage cavern and the storage reservoir. The two differ with regard to the reservoir rock and the storage mechanism.

1.1 Intrinsic Value of Gas Storage

The traditional use of storage resides in balancing a relatively stable annual supply and a highly seasonal demand. The gas price differential between the injection and withdrawal season (“seasonal spread”) has therefore always been seen as a fundamental driver of storage value from the storage customer’s point of view. But seasonal spread only does not reflect the full value of storage. It ignores the short-term value extraction, disregards system efficiency and especially the value originating from the real and physical detention of gas (insurance value). In fact, seasonal spread reflects the intrinsic value on the Future market which is only one part of the market and often has less liquidity than the Day-Ahead market.

Due to the seasonal spreads decline since 2007, sourcing gas on spot market has become more economically attractive than storage. Thus, as the choice of flexibility tools is mainly driven by prices, many market players tend to favour hub-sourced products in covering their flexibility needs as sourcing gas on spot market...
is more economically attractive\(^3\) – even if these products do not ensure the physical availability of gas.

### 1.2 Extrinsic Value of Gas Storage

The extrinsic value is mainly driven by the volatility of gas prices and reflects the potential value the storage customer is able to realize due to price movements on the spot market (Figure 2).

From the customer’s point of view it is relevant to look at all theoretical price deltas over time (Figure 2) and how storage services can best be used to realize that volatility in prices. Customers have a choice of storage products ranging from “fast-churn”\(^4\) storage mainly offered in salt caverns to “seasonal”\(^5\) storage products. The different products reflect the technical capabilities of the individual storage facilities. Fast churn products are mainly offered in salt caverns while seasonal products are typical for depleted fields.

Volatility on the Spot market also influences prices on the balancing energy market. Flexibility coming from UGS is one of the main sources in the balancing energy market and can therefore reduce costs for Balancing Energy or generate extra revenues in times of high prices.

Thus, the value of gas storage can be regarded as the maximum expected revenues that a storage user can obtain by optimally using the storage capacity. The Storage user has to assess value versus costs (Figure 3).

### 1.3. UGS contributes to “System Stability” and Security of Supply

Storage facilities are very often located relatively close to centres of demand, whereas in most other situations gas has to be transported from the border of the network (e.g. production facilities, interconnectors, LNG terminals).

Upstream, UGS also helps to reduce investment expenditure in wells and surface facilities and to manage gas production operations more efficiently. It also provides security in case of technical problems in gas production. This turns into reduced costs, extended lifespan of production fields and maximized volumes extracted.

Downstream, flows in the gas grid from storage can generally be expected at times of high and peak demand. Therefore gas grid operators are able to dimension import pipelines to meet a lower net flow at peak times, which could in principle provide significant savings in investment costs. Through modelling the network infrastructure with and without storage, potential saved capital costs can be calculated.

By providing additional pressure to the system, storage also helps reduce the run time of compression stations along the transport lines and lowers the operating costs.

In Figure 4 it is evident that storage has made up a significant proportion of European flows on high demand days over the last three years compared to other supply sources.

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\(^3\) In 2013 when the spread was below 1.5 €/MWh filling rates in continental Europe were at their lowest point.

\(^4\) “Fast” storage facilities have high injection/withdrawal rates relative to their working gas capacity, which allows the gas volume to be turned over several times.

\(^5\) “Seasonal” products have a relatively high working gas capacity in comparison to their injection/withdrawal rates and are particularly suited for seasonal use.
2. UGS AS BACKBONE OF SECURITY OF SUPPLY IN EUROPE

One of the cornerstones of the European energy policy (“Energy Union”) is to set the right regulatory framework to ensure a safe and secure gas infrastructure with adequate levels of security of supply. The gas industry has done huge efforts to reach that high level of a sufficient and well connected gas infrastructure. At the same time it should be borne in mind that in recent years the use of storage capacities by trading oriented market participants has diminished, creating a potential serious exposure of the European gas market to supply disruptions.

The current market design in the gas sector has been built on the assumption that storage capacity was in high demand and hence that available storage capacities would always be booked and used. However, market conditions for the storages have deteriorated substantially in most parts of Europe over the last years. Market prices for storage capacity have dropped below cost level for storage operators, as market parties increasingly rely on other (short term) flexibility tools to satisfy their portfolio needs. In particular flexibility contracted via Long Term Contracts (LTCs) and hubs have gained a larger relative share of the flexibility market and reliance on such flexibility tools for sourcing gas in case of a supply crisis could proof insufficient if there is no physical backup behind these sources.

Market players might anticipate that the worst situation will never materialize, or rely on governments taking over this risk through intervention in an EU-declared emergency situation; which would be beyond the force majeure provisions in typically commercial supply contracts.

The primary aim of an appropriate future regulatory framework for gas storage should therefore be to ensure the best possible use of the existing storage capacity. Ideally the market has the right incentives to make full use of storage capacities. Security of supply is best ensured by having storages fully booked and filled ahead of the winter. It is therefore important to find solutions to induce market players to take the value of security of supply fully into account or enforce the supply standards to ensure utilization of storages.

2.1 Different SOS models in Europe

The models implemented vary between market oriented approaches and regulatory interventions with booking obligations.

One solution to improve Security of Supply could be through government-controlled strategic stocks. This model is also well practiced in the oil sector. In countries without a well-functioning storage market and where the gas supply situation is vulnerable strategic stocks can considerably improve the security of supply situation (Figure 5).

In countries like France or the Czech Republic booking obligations are implemented. The supplier of protected customers has to secure an amount of gas in storage for the winter period. A minimum level of gas with a pre-defined defined profile has to be kept in stock during the winter season.

In the Netherlands the TSO is responsible to have access to gas in storage within its Balancing Zone under pre-defined conditions like cold temperature.

2.1.1 German Discussion on SOS measures

A similar discussion is currently going on in Germany to guarantee a minimum gas storage filling level. The German Federal Ministry of Economics has recently presented their views on the security of supply situation in the gas sector based on a study6 and discussions with the industry. The Ministry comes to the conclusion that the gas sector is well positioned with sufficient infrastructure and security. Natural gas supply in Germany is currently ensured to a large degree. Regulatory intervention should be limited (no strategic reserve or booking obligations). The focus should be on mar-

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6 “Possibilities to improve gas security and crisis prevention via regulation of storage (strategic reserve, storage obligations), including the costs and the economic effect on the market” A study commissioned by the Federal Ministry for Economic Affairs and Energy – Bundesministerium für Wirtschaft und Energie (BMWi)
ket oriented measures to maintain the high supply levels. The market area manager (MGV) representing the TSOs in a balancing zone shall be allowed to procure higher gas volumes as flexibility reserve in order to secure emergency situations. If no additional short term balancing energy offers are available to keep the system balanced, shippers can participate in a tender process and have to guarantee pre-defined physical flows at certain locations upon request by TSOs. The procured gas from gas storage facilities would then be released to the network in the event of a proven market failure.

As a second measure demand-side management should be strengthened. New physical balancing energy products shall be created which allow a wider range of customers to make a voluntary reduction gas demand (Demand Side Management) contributing to security of supply. This should be an organized market where industrial customers or their suppliers should be enabled to offer a reduction of loads in a tender process in exchange for the payment of a premium.

The German Ministry intends to work with BNetzA on the detailed rules to implement this measures before next winter 16/17.

2.1.2 Market based approaches in German, Austria and UK

Currently these countries follow to the minimum requirements according to the EU SOS Regulation Nr/994/2010, where the supplier of protected customers is obliged to continue supply with gas even under highly demanding situations, such as prolonged periods of extreme cold or a failure of a major supply infrastructure or disruptions from a major upstream supplier. But there is no definite obligation how to fulfill the Supply Standard. It depends on the effectiveness how the involved national authorities monitor the compliance with the SOS Regulation. In Austria E-Control regularly monitors the fulfillment of the Supply Standard by suppliers of protected customers.

In the UK additional incentives have been implemented under the concept of Value of Lost Load (“VoLL”). It ensures that the cost of involuntarily interrupting consumers is incorporated into a cash-out regime to avoid that involuntary consumer interruptions have to be balanced by TSO to resolve a system imbalance. The UK-System focuses on improving the efficiency of price signals and transferring risks from consumers to suppliers. Revenue collected through cash-out of imbalanced suppliers is used to pay consumers that are involuntarily interrupted. For example a domestic household customer is priced at £14/therm, which is approximately 70 € per day to compensate the costs of an interruption of a household on a cold winter day.

Such price signals should give an incentive to the suppliers to source their supply portfolio with high physical availability in case of congestion.

7 Bundesnetzagentur
8 Energie Control Austria - Regulator for Gas and Electricity
9 Graphs are based on ENTSOG data and show volumes for the EU-28

Figure 4: Use of Gas storage in Europe

1 Graphs are based on ENTSOG data and show volumes for the EU-28
2.2 SOS is on top of the EU Energy Policy agenda in 2016

In February 2016 the European Commission will present changes in the EU SOS Regulation 994/2010. It can be expected that market based solutions are preferred and no "one size fit all" model on storage obligation will be presented. The reason is that there is no sole common "storage prescription" as each country’s energy system has different parameters to be considered when assessing the storage requirement. The gas market in Europe differs in regard to import dependency, ability to cover seasonal modulation needs and peak demand, gas share of the energy mix and characteristics of existing storage facilities.

But what needs to be addressed under a market oriented approach in the new SOS Regulation is that flexibility in sourcing requires the proof of the physical availability of the flexibility service used by suppliers in Europe. Supply contracts traded at the Hubs with no obligation of physical delivery will not provide a solution in case of a supply disruption. To ensure a level playing field for all market players, the Regulation should be extended to introduce a new criterion such as "physical availability of the supply sources" to be fulfilled by each individual market player to supply the group of his protected customers.

3. STORAGE MARKET NEEDS A COMPETITIVE ENVIRONMENT IN THE REGULATORY FRAMEWORK

The choice of flexibility tools is driven mainly by economics and not primarily by overall SOS considerations. In order to compete with other sources of flexibility, storage operators need to be able to offer products under a more attractive regulatory framework that responds to increasingly varied user needs.

Different regulatory regimes like TPA rules, regulated storage tariffs, different tariff network and capacity regimes hamper the nondiscriminatory access to storage services and their cross border use between market zones.

3.1 Fair Network tariffs at storage connection points

Across Europe there are significant differences in the level of network tariffs for storage usage, which hinders competition. Compared to other flexibility sources such as long term supply contracts, LNG or Hub Services which are only charged when entering the market zone once, injection and withdrawal into storage is charged twice with network tariffs. As regards absolute tariffs that TSOs charge to enter and exit storage facilities, they vary significantly. While in Denmark there is no additional fee the storage customer in the Netherlands has to pay 1-2€/MWh for stored gas. When setting tariffs for entry and exit points from and to gas storage facilities, it shall be considered that gas storage is not a net source of supply or demand and users already paid entry- and exit tariffs at import/ production and at end consumption. The tariff at these points shall cover incremental costs if not compensated by the benefits of gas storages contributing to the network system. The latest change of the tariff methodology implemented in Germany which came into on 1

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rules set by of BNetzA contradicts a fair and cost reflective pricing regime at storage connection capacities.
points within and between market zones because the initial intention to release pressure on high tariffs for storage transports resulted contrary in higher fees than before.

Mid of December the European Commission presented first ideas on their concept for legally binding tariffs rules\textsuperscript{11} for gas transmission on the European level. According to this a 50% discount on storage entry/exit tariffs should be given as default rule that acknowledges generally positive contribution storages have to system operation and security. If a Member State deviates from this principle it must be individually scrutinized. It is expected that by the end of 2016 the European Commission will adopted binding tariff rules that hopefully also covers a fair and adequate tariff regime for storage transports.

3.2 Firm transport products at storage connection points

There are several examples where access of storage is limited due to lack of sufficient transport capacity. In most Entry/Exit zones in Europe, network users have a restrained access to/from storage at storage-transmission interconnection points because of different capacity products. Terms and conditions of interruption vary from country to country. In some countries the risk of being interrupted is related to the temperature, peak load or seasonal factors in the network system, while in other E/E zones capacity at storage interconnection points is only offered on an interruptible basis.

For instance in Germany and Austria only restricted capacity products are offered for storage transports. In those cases where the TSO does not offer firm capacity products at storage interconnection points, it is important that the conditions on which the TSO interrupts are transparent and predictable. Hence, unconstrained access of storage to the transmission grid is essential to ensure that storage users can compete on an equal footing with other flexibility sources.

3.3 Flexibility to offer innovative storage products

Finally, in order to ensure a level playing field between all the flexibility tools, it is crucial for SSOs to be able to answer to their customers’ needs by offering innovative products to the market. The current legal framework under the 3rd Energy Package considers the storage market as a natural monopoly with strict rules on TPA, transparency and Unbundling. But today, in most EU countries there is a highly competitive market for flexibility services with various alternatives. This often hinders SSOs to offer customized flexibility products from storage. While SSOs have to fulfill strict Unbundling requirements and are not allowed to take part in the commodity market, competitors are allowed to do so.

The existence of a liquid flexibility market should be recognized in the future regulatory framework, where storage competes with other flexibility tools.

4. CONCLUSIONS

SSOs find themselves in a situation which requires them to compete with price signals that are below the costs they incur to operate and maintain their facilities – which is not sustainable in the long term. SSOs are reacting with mothballing/closing of storage facilities, project shifts, termination and depreciation\textsuperscript{12}, to save operating costs or to reallocate capital to more profitable uses. But policy makers should not forget that UGS are a vital component of the natural gas chain and a necessary backbone of the European security of supply. Moreover, as a renewable back-up, flexibility from underground gas storage is a key factor of success for the European climate policy. SSOs undertake high efforts to offer innovative and competitive products on the market for flexibility but need a level playing field and the right regulatory incentives that full value of UGS is much better reflected in the current gas market design.